

NASA's Deep Impact Mission: Decision Making

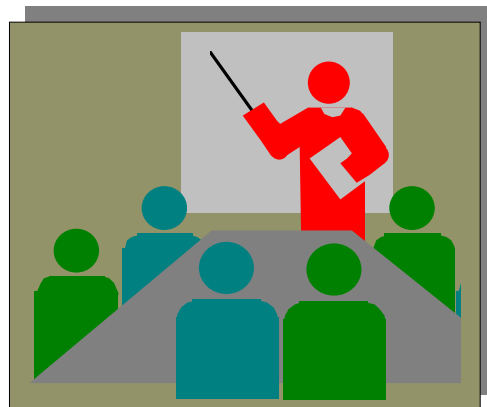
Refining the Issues

TEACHER GUIDE

BACKGROUND INFORMATION

In this activity, students present a case for a particular data observation strategy scenario that is to be used to inform and convince others.

Student groups will use the materials prepared in the last activity to present and defend the cost, risk and benefits, and quality (meeting science objectives) of their chosen observation strategy. Students assume roles of various stakeholders of the mission including scientists, engineers, and the interested public such as environmentalists, politicians, teachers, students, and others. General guidelines are provided for students to follow for each role, though they are encouraged to build the position of the role they are portraying. Prior to the debate, students will study text profiles or audio clips of some of the stakeholders in order to bring additional information into the mix. Students use the information from the presentations in order to prepare for a debate about the data observation strategies at a public forum. The case built by each group includes the details on the observation strategy or combination of methods being advocated, specific details for implementing that method, and the pros and cons for that method.



The National Science Education Standards call for students to communicate scientific procedures and explanations. In the process, students describe and explain ideas and concepts, make predictions, and demonstrate processes and techniques using models. Throughout their delivery of the presentation, students must base the claims they present on evidence and logical argument. Therefore, it is important that in developing their presentation package, students have decided what evidence to use, and that they have prepared to defend certain evidence or anomalous data. During presentations and debate, students should demonstrate that they have given considerable thought to the manner they have chosen to use to communicate the techniques and methods they used to generate, analyze, and draw conclusions from their evidence. The various uses of mathematics they have employed should be demonstrated, as well as the processes they used to gather, organize, and present data. Students also learn to take the position of stakeholders that must learn what is required to make a rational and informed decision in the next activity. To do this, they use role guides that illustrate the positions of scientists, engineers, technicians, and public citizens who will each pose different concerns and questions.

Each group's solution relates to human needs, desires, and opinions, and these are a part of the debate in this activity, and a part of the decision-making process in which the students engage in the next activity. Every data collection solution being prepared will have side effects, and each student should pose questions around how well the group and their observation strategy balances costs and risks of their solution with the benefits that will be recognized. Students should also ask questions about how the science is possibly advanced due to technology advocated in the chosen method, and how the technology can in turn be driven to higher standards by the science that may be gained as a unique result of use of the method. Each group's back-up measures should be explained and thoroughly queried. This process exists in an effort to uncover any information necessary to select the method in the next activity that best reduces the risk, realizing elimination is not possible. Finally, students should demonstrate creativity and insight in their presentations, in the recognition that in the next activity it is people, not scoring machinery, who will determine the method of collection considered most worthy for the mission.

NATIONAL SCIENCE STANDARDS ADDRESSED

Grades 5-8

[Science As Inquiry](#)

Abilities Necessary to do scientific inquiry.

Develop descriptions, explanations, predictions, and models using evidence.

Think critically and logically to make the relationships between evidence and explanations.

Communicate scientific procedures and explanations.

Use mathematics in all aspects of scientific inquiry.

[Science and Technology](#)

Understandings about science and technology.

[Science in Personal and Social Perspectives](#)

Risks and benefits.

Science and technology in society.

[History and Nature of Science](#)

Science as a human endeavor.

Nature of science.

Grades 9-12

[Science As Inquiry](#)

Abilities Necessary to do scientific inquiry.

Formulate and revise explanations and models using logic and evidence.

Recognize and analyze alternative explanations and models.

Communicate and defend a scientific argument.

[Science and Technology](#)

Understandings about science and technology.

[History and Nature of Science](#)

Science as a human endeavor.

Nature of scientific knowledge.

(View a full text of the [National Science Education Standards](#).)

LANGUAGE ARTS STANDARDS ADDRESSED

Standard: 8 Demonstrates competence in speaking and listening as tools for learning.

Level III Grades 6-8

[Listening and Speaking](#)

Conveys a clear main point when speaking to others and stays on the topic being discussed.

Presents simple prepared reports to the class.

Level IV Grades 9-12

[Listening and Speaking](#)

Adjusts message wording and delivery to particular audiences and for particular purposes (e.g., to defend a position, to entertain, to inform, to persuade).

Makes formal presentations to the class (e.g., includes definitions for clarity; supports main ideas using anecdotes, examples, statistics, analogies, and other evidence; uses visual aids or technology).

Responds to questions and feedback about own presentations (e.g., defends ideas, expands on a topic, uses logical arguments).

(View a full text of the McREL [Compendium of Standards and Benchmarks for K-12 Education](#))

MATERIALS

For each student:

- [“Public Forum Role Sheets”](#)
- Completed Student Presentation Guides, [“Defend This!”](#) (from last activity)
- Assessment Guide, [“Critiquing Ideas”](#)
- Student Text, [“Communicating, Questioning, and Listening”](#)
- Prepared presentation aids (poster board, computer disks, etc.)

Teaching Tip

Ask students to write additional roles on the Forum Role Sheets.

PROCEDURE

1. Tell students that they are now going to use their group’s preparations from the last activity in order to present their observation strategy ideas for science team and public review. Tell them to move into their groups only when they are called upon to present. During the presentations by other groups, they will assume various roles in the public forum, and one representative of each role will be chosen to “officially” represent that role on a panel. Tell students that they each must play the role of a panel representative during at least one presentation. They will play each role at least once, and so will need to become familiar with each role for the stakeholders involved in the meeting. Tell students that they will have 10–15 minutes of the class period in their group at the start of the period in which they are to present to review the plans and procedures they will follow in their presentation. During that time, other students will work in a different group, comprised of those students who will assume a particular role in the audience, and the panel representative for that role.
2. Ask students who are to present to move into their groups, and to go over their presentation quietly. Make sure they have all presentation aids, illustrations, data, notes and note cards, etc. ready, as well as the sequence in which they will present. The primary information they need should be on the completed student presentation guide from the last activity. They may be allowed to prepare the front of the classroom for their presentation. This could include posting any signage they wish (e.g., name of observation strategy, data or evidence charts, graphs, etc.), preparation of overhead projector and distance of projector from screen, organizing transparencies, computer and projector connections, and so forth. Distribute the “Public Forum Role Sheets” to each of the other students, and ask them to select the role they wish to play, or assign that role. If students choose, you may need to ask for volunteers to switch to another role for the day, as it is important to have a fairly equal number of representatives for each role during the presentation. Students should realize that they will play each role at least once anyway, so it should not be an

Alternate Strategy Tip

For a writing extension, ask students to write additional role sheets that can be used during the debate. Examples could include, politicians, outside reviewer, teachers, students, media relations personnel, and others.

Teaching Tip

Students, especially those in middle school, often enjoy preparing for roles as specific people, with character traits and motivations specific to their character. You may wish to allow students to build upon their roles by incorporating a name for their character and/or a specific title. This could even lead to research on the various occupations and specialized careers available to students looking to the possibilities of a future in space science, astronomy, or even NASA. Some students might enjoy dressing the part of their role. Take care, however, to avoid stereotypes in extending the role-playing activity to this point.

Teaching Tip

As you preview the assessment guide with your students, you should help them define any words they may not understand.

issue. Ask them to move into groups with the other students who will assume that role and prepare their part for the day. Their preparation should include becoming familiar with the specific concerns for the audience roles they will represent, and the types of questions they may ask. The preparation of the exact

questions to ask cannot be entirely created prior to hearing the presentation, but students can be prepared to look for certain cues and areas their character would like to see addressed. Pass out the Student Text "Communication, Questioning, and Listening" to all students, and ask that they read through the strategies given to help them better attend to their roles during the presentation. At this time they should also choose their role's panel representative.

3. Distribute a copy of the assessment guide, "Critiquing Ideas." Explain to students what each category of the guide means, that the scores within each category represent a continuum, and that they should use the guide to assess on the continuum where each group falls as they make their presentation. Students should note that some categories provided deal specifically with the evidence and other information that supports or does not support their chosen data observation strategy. Other categories deal with delivery and presentation technique, preparedness, quality of visual aids, and so forth. Tell them you will also use a similar guide to assess each group. Note that the rubric contains space for you to add criteria of your own, if you choose to do so. You may even wish to design additional scoring criteria together with your students. Students should realize the importance of their responsiveness and participation in representing a particular audience and/or panel role. Now is also a good time to post the forum rules, or distribute copies for students to review.
4. Ask a student group to conduct its presentation, and audience members to adhere to their roles during the presentation. Ask each student to complete their critique of the group's performance and quality of its "case." Conduct your own assessment of the group as well. Allow at least 5 minutes at the end of the presentation for completing the critique.

Teaching Tip

It is difficult for students to effectively critique their classmates, but the critique is an essential part of the learning they derive from this stage of the cycle. To help prepare them to accomplish this task effectively, you may use a short video of a group or individual making a presentation that is intended to be persuasive. Ask them to evaluate the presentation using a modified version of the critique guide. It is not necessary for the presentation to specifically deal with observation strategies. Students should compare and students may discuss the reasons why they assigned a particular score. You may even use a particular group's presentation from your own class if you see the need after the presentations have begun. Remember to acquire written permission from students prior to filming or using video or pictures of them for any purposes.

Teaching Tip

Consider conducting the presentations as a press conference. Videotape the press conference so that it can be reviewed later. Student should decide what information they want the public to know.

Students should also choose graphics that would gain the public's attention.

RESOURCE

National Research Council. (2000). *Inquiry and the National Science Education Standards*. National Academy Press. Washington, D.C.